PRECALCULUS MIDTERM REVIEW CHAP. 3 NAME _____ MOD ____

List the potential rational zeros of the polynomial function. Do not find the zeros.

1) $f(x) = 6x^4 + 2x^3 - 3x^2 + 2$ 1) _____

A) $\pm\frac{1}{6}, \pm\frac{1}{3}, \pm\frac{1}{2}, \pm 1, \pm 2$

B) $\pm\frac{1}{2}, \pm\frac{3}{2}, \pm 1, \pm 2, \pm 3, \pm 6$

C) $\pm\frac{1}{6}, \pm\frac{1}{3}, \pm\frac{1}{2}, \pm\frac{2}{3}, \pm 1, \pm 2$

D) $\pm\frac{1}{6}, \pm\frac{1}{3}, \pm\frac{1}{2}, \pm\frac{2}{3}, \pm 1, \pm 2, \pm 3$

Find the vertical asymptotes of the rational function.

2) $f(x) = \frac{x + 11}{x^2 - 25x}$ 2) _____

A) $x = -5, x = 5$

B) $x = 0, x = 25$

C) $x = 25, x = -11$

D) $x = 0, x = -5, x = 5$

Give the equation of the oblique asymptote, if any, of the function.

3) $f(x) = \frac{x^2 + 2x + 7}{x + 9}$ 3) _____

A) $y = x - 7$

B) $x = y - 7$

C) $y = x - 11$

D) no oblique asymptotes

Give the equation of the horizontal asymptote, if any, of the function.

4) $h(x) = \frac{6x^3 - 3x - 8}{8x + 6}$ 4) _____

A) $y = 0$

B) $y = 6$

C) $y = \frac{3}{4}$

D) no horizontal asymptotes

Find the vertex and axis of symmetry of the graph of the function.

5) $f(x) = x^2 + 2x - 3$ 5) _____

A) $(1, -4);\ x = 1$ B) $(-1, 4);\ x = -1$ C) $(-1, -4);\ x = -1$ D) $(1, 4);\ x = 1$

For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x-axis at each x -intercept.

6) $f(x) = \frac{1}{5}x^4(x^2 - 3)$ 6) _____

A) 0, multiplicity 4, crosses x-axis;
$\sqrt{3}$, multiplicity 1, touches x-axis;
$-\sqrt{3}$, multiplicity 1, touches x-axis

B) 0, multiplicity 4, touches x-axis;
$\sqrt{3}$, multiplicity 1, crosses x-axis;
$-\sqrt{3}$, multiplicity 1, crosses x-axis

C) 0, multiplicity 4, touches x-axis

D) 0, multiplicity 4, crosses x-axis

Use the Factor Theorem to determine whether x - c is a factor of f. If it is, write f in factored form, that is, write f in the form f(x) = (x - c)(quotient).

7) $f(x) = 2x^4 - 7x^3 + 13x^2 - 28x + 20;\ c = 1$ 7) _____

A) Yes; $f(x) = (x - 1)(2x^3 + 6x^2 + 8x - 20)$

B) Yes; $f(x) = (x - 1)(2x^3 - 5x^2 + 8x - 20)$

C) Yes, $f(x) = (x - 1)(2x^3 - 5x^2 - 9x - 20)$

D) No

Determine the domain and the range of the function.

8) $f(x) = -3x^2 - 2x - 12$ 8) _____

A) domain: all real numbers
range: $\left\{y \mid y \le -\frac{35}{3}\right\}$

B) domain: all real numbers
range: $\left\{y \mid y \ge \frac{35}{3}\right\}$

C) domain: all real numbers
range: $\left\{y \mid y \ge -\frac{35}{3}\right\}$

D) domain: all real numbers
range: $\left\{y \mid y \le \frac{35}{3}\right\}$

Form a polynomial f(x) with real coefficients having the given degree and zeros.

9) Degree 3: zeros: 1 + i and -10 9) _____

A) $f(x) = x^3 - 10x^2 - 18x - 12$

B) $f(x) = x^3 + 8x^2 - 18x + 20$

C) $f(x) = x^3 + 8x^2 + 20x - 18$

D) $f(x) = x^3 + x^2 - 18x + 20$

Information is given about a polynomial f(x) whose coefficients are real numbers. Find the remaining zeros of f.

10) Degree 6; zeros: 2, 1 + i, -4 - i, 0 10) _____

A) -1 + i, 4 - i B) -2, 1 - i, -4 + i C) 1 - i, -4 + i D) -1 - i, 4 + i

Solve the problem.

11) The amount of time it takes a swimmer to swim a race is inversely proportional to the average speed of the swimmer. A swimmer finishes a race in 50 seconds with an average speed of 3 feet per second. Find the average speed of the swimmer if it takes 30 seconds to finish the race. 11) _____

12) A closed box with a square base has to have a volume of 12,000 cubic inches. Find a function for the surface area of the box. 12) _____

13) The owner of a video store has determined that the cost C, in dollars, of operating the store is approximately given by $C(x) = 2x^2 - 20x + 600$, where x is the number of videos rented daily. Find the lowest cost to the nearest dollar. 13) _____

Solve.

14) The volume V of a given mass of gas varies directly as the temperature T and inversely as the pressure P. A measuring device is calibrated to give $V = 162.4\ in^3$ when $T = 290°$ and $P = 25\ lb/in^2$. What is the volume on this device when the temperature is 340° and the pressure is $20\ lb/in^2$? 14) _____

A) $V = 17\ in^3$ B) $V = 238\ in^3$ C) $V = 258\ in^3$ D) $V = 218\ in^3$

Solve the inequality.

15) $x^2 - 5x - 14 \le 0$ 15) _____

16) $x^2 - 7x + 12 > 0$ 16) _____

17) $\frac{(x+9)(x-4)}{x-1} \ge 0$ 17) _____

Find all of the real zeros of the polynomial function, then use the real zeros to factor f over the real numbers.

18) $f(x) = x^3 + 3x^2 - 4x - 12$ 18) _____

Solve the equation in the real number system.

19) $2x^3 - x^2 - 6x + 3 = 0$ 19) _____

Find all zeros of the function and write the polynomial as a product of linear factors.

20) $f(x) = x^3 + 7x^2 + 16x + 10$ 20) _____

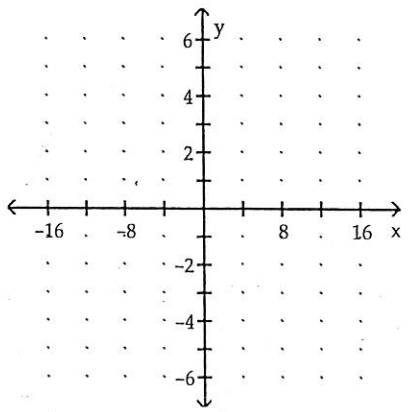
Use a graphing calculator to plot the data and find the quadratic function of best fit.

21) An engineer collects data showing the speed s of a given car model and its average miles per gallon M. Use a graphing calculator to plot the scatter diagram. What is the quadratic function of best fit? 21) _____

Speed, s	mph, M
20	18
30	20
40	23
50	25
60	28
70	24
80	22

Graph the function.

22) $f(x) = \dfrac{(x - 5)(x + 5)}{x^2 - 36}$ 22)



Analyze the graph of the given function f as follows:

(a) Determine the end behavior: find the power function that the graph of f resembles for large values of $|x|$.

(b) Find the x- and y-intercepts of the graph.

(c) Determine whether the graph crosses or touches the x-axis at each x-intercept.

(d) Graph f using a graphing utility.

(e) Use the graph to determine the local maxima and local minima, if any exist. Round turning points to two decimal places.

(f) Use the information obtained in (a) - (e) to draw a complete graph of f by hand. Label all intercepts and turning points.

(g) Find the domain of f. Use the graph to find the range of f.

(h) Use the graph to determine where f is increasing and where f is decreasing.

23) $f(x) = (x + 3)(x - 3)^2$ 23) _____

PRECALCULUS MIDTERM REVIEW CHAP. 4 NAME _____ MOD _____

Find the exact value of the logarithmic expression.

1) $\log_8 \frac{1}{512}$ 1) _____

A) 64 B) 3 C) -3 D) -64

Solve the exponential equation. Express the solution set in terms of natural logarithms.

2) $5^{x+8} = 6$ 2) _____

A) $\left\{\frac{\ln 5}{\ln 6} + \ln 8\right\}$ B) $\left\{\frac{\ln 6}{\ln 5} - 8\right\}$

C) {ln 6 - ln 5 - ln 8} D) $\left\{\frac{\ln 5}{\ln 6} + 8\right\}$

Write as the sum and/or difference of logarithms. Express powers as factors.

3) $\log_5\left(\frac{x-6}{x^7}\right)$ 3) _____

A) $7\log_5 x - \log_5 (x-6)$ B) $\log_5 (x-6) - 7\log_5 x$

C) $\log_5 (x-6) + 7\log_5 x$ D) $\log_5 (x-6) - \log_5 x$

Find the domain of the function.

4) $f(x) = \ln\sqrt{x}$ 4) _____

A) $(-\infty, 0)$ B) $(1, \infty)$ C) $(-\infty, 1)$ D) $(0, \infty)$

Find the value of the expression.

5) Let $\log_b A = 3.932$ and $\log_b B = 0.150$. Find $\log_b AB$. 5) _____

A) 26.144 B) 4.082 C) 3.782 D) 0.591

Solve the problem.

6) Which of the two rates would yield the larger amount in 1 year: 9% compounded monthly or $9\frac{1}{4}\%$ compounded annually? 6) _____

A) 9% compounded monthly

B) $9\frac{1}{4}\%$ compounded annually

C) They will yield the same amount.

Find the domain of the composite function f ∘ g.

7) $f(x) = x + 7; \quad g(x) = \frac{7}{x+2}$ 7) _____

A) $\{x \mid x \neq -9\}$ B) {x | x is any real number}

C) $\{x \mid x \neq -2\}$ D) $\{x \mid x \neq -2, x \neq -7\}$

Solve the equation.

8) $6 + 6\ln x = 15$ 8) _____

A) $\{e^{3/2}\}$ B) $\left\{\frac{9}{6\ln 1}\right\}$ C) $\left\{\ln\left(\frac{3}{2}\right)\right\}$ D) $\left\{\frac{e^9}{6}\right\}$

Find the exact value of the logarithmic expression.

9) $\ln e^9$ 9) _____

A) $\frac{1}{9}$ B) e C) 1 D) 9

Use the properties of logarithms to find the exact value of the expression. Do not use a calculator.

10) $\log_{112} 8 + \log_{112} 14$ 10) _____

A) 14 B) 8 C) 112 D) 1

Express as a single logarithm.

11) $3\log_6 x + 5\log_6 (x - 6)$ 11) _____

A) $15 \log_6 x(x - 6)$ B) $\log_6 x(x - 6)$ C) $\log_6 x(x - 6)^{15}$ D) $\log_6 x^3(x - 6)^5$

Decide whether or not the functions are inverses of each other.

12) $f(x) = 8 - 9x$; $g(x) = \frac{x}{9}(x - 8)$ 12) _____

A) No B) Yes

Find the indicated composite for the pair of functions.

13) $(f \circ g)(x)$: $f(x) = \sqrt{x + 9}$, $g(x) = 8x - 13$ 13) _____

For the given functions f and g, find the requested composite function value.

14) $f(x) = \sqrt{x + 3}$; $g(x) = 3x$; Find $(f \circ g)(2)$. 14) _____

The function f is one-to-one. Find its inverse.

15) $f(x) = \sqrt[3]{x + 7}$ 15) _____

Solve the problem.

16) The half-life of plutonium-234 is 9 hours. If 70 milligrams is present now, how much will be present in 4 days? (Round your answer to three decimal places.) 16) _____

17) Find the amount owed at the end of 8 years if $5000 is loaned at a rate of 5% compounded monthly. 17) _____

18) The logistic growth function $f(t) = \frac{680}{1 + 5.8e^{-0.18t}}$ describes the population of a species of butterflies t months after they are introduced to a non-threatening habitat. What is the limiting size of the butterfly population that the habitat will sustain? 18) _____

19) What principal invested at 8% compounded continuously for 4 years will yield $1190? Round the answer to two decimal places. 19) _____

20) The formula $A = 297e^{0.046t}$ models the population of a particular city, in thousands, t years after 1998. When will the population of the city reach 540 thousand? 20) _____

21) A nuclear scientist has a sample of 100 mg of a radioactive material which has a half-life in hours. She monitors the amount of radioactive material over a period of a day and obtains the following data. Use a graphing utility to fit an exponential function to the data. Predict the amount of material remaining at 40 hours. 21) _____

Hours	0	5	10	15	20	25	30
mg	100	68.3	45.2	31.3	21.5	14.6	9.8

22) A thermometer reading 12°C is brought into a room with a constant temperature of 25°C. If the thermometer reads 17°C after 5 minutes, what will it read after being in the room for 9 minutes? Assume the cooling follows Newton's Law of Cooling: 22) _____

$U = T + (U_0 - T)e^{kt}$.

(Round your answer to two decimal places.)

Use the Change-of-Base Formula and a calculator to evaluate the logarithm. Round your answer to two decimal places.

23) $\log_2 231.7$ 23) _____

Solve the equation.

24) $\log_5 (4x + 7) = \log_5 (4x + 4)$ 24) _____

25) $\log_3 (x - 4) + \log_3 (x - 10) = 3$ 25) _____

26) $2^{x^2 - 3} = 64$ 26) _____

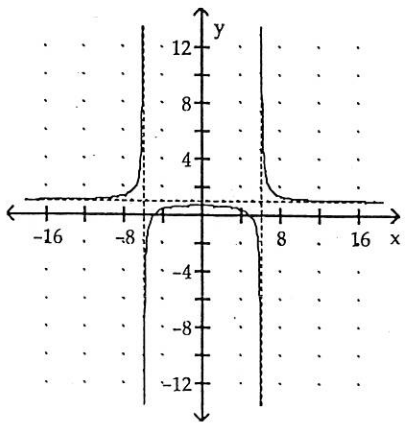
Solve the exponential equation. Use a calculator to obtain a decimal approximation, correct to two decimal places, for the solution.

27) $e^{5x} = 8$ 27) _____

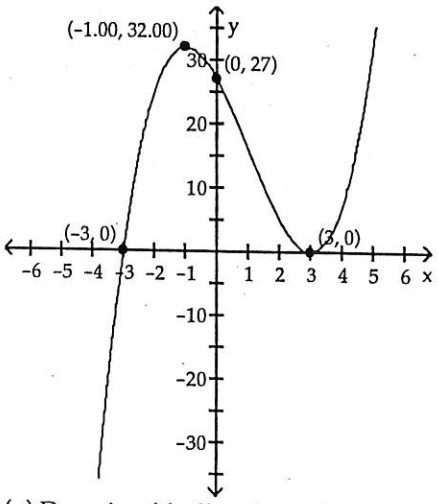
Use a graphing calculator to solve the equation. Round your answer to two decimal places.

28) $e^x = x^3$ 28) _____

1) C
2) B
3) A
4) D
5) C
6) B
7) B
8) A
9) B
10) C
11) 5 feet per second
12) $S(x) = 2x^2 + \frac{48{,}000}{x}$
13) $550
14) B
15) $[-2, 7]$
16) $(-\infty, 3)$ or $(4, \infty)$
17) $[-9, 1)$ or $[4, \infty)$
18) $-3, -2, 2$; $f(x) = (x + 3)(x + 2)(x - 2)$
19) $\left\{\frac{1}{2}, \sqrt{3}, -\sqrt{3}\right\}$
20) $f(x) = (x + 1)(x + 3 + i)(x + 3 - i)$
21) $M(s) = -0.0063x^2 + 0.720x + 5.142$
22)



23) (a) For large values of $|x|$, the graph of f(x) will resemble the graph of $y = x^3$.
(b) y-intercept: (0, 27), x-intercepts: (3, 0) and (-3, 0)
(c) The graph of f crosses the x-axis at (-3, 0) and touches the x-axis at (3, 0).
(e) Local minimum at (3, 0); Local maximum at (-1.00, 32.00)
(f)



(g) Domain of f: all real numbers; range of f: all real numbers
(h) f is increasing on $(-\infty, -1.00)$ and $(3, \infty)$; f is decreasing on $(32.00, 3)$

1) C
2) B
3) B
4) D
5) B
6) A
7) C
8) A
9) D
10) D
11) D
12) A
13) $2\sqrt{2x - 1}$
14) 3
15) $f^{-1}(x) = x^3 - 7$
16) 0.043
17) $7452.93
18) 680 butterflies
19) $864.12
20) 2011
21) $y = 100e^{-0.077x}$, 4.6 mg
22) 19.57°C
23) 7.86
24) ∅
25) {13}
26) {3, -3}
27) {0.42}
28) {1.86}